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Acquisition Program Lead Systems Integration/Lead Capabilities Integration Decision Support Methodology and Tool

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14. ABSTRACT
Naval Air Warfare Center???Aircraft Division (NAWCAD) wants to ensure that program offices derive the best value for their resources. These program offices need to understand their most effective cost, schedule, and performance-based solutions when faced with an acquisition requirement. Comparisons for sourcing are complex and require extensive decision support analysis to understand the solution space and foresight between original equipment manufacturers (OEMs) and government entities performing the Lead System Integrator (LSI) role. The research focused on the question, how can program managers best determine their acquisition source solutions in a timely and cost-effective manner? The method used was to develop a simulation tool to assist program offices in evaluating the relative risks of utilizing NAWCAD and commercial OEMs for various LSI roles and responsibilities. Lone Star Aerospace Inc. was tasked to develop a simulation tool to address highly complex issues for customers in NAVAIR. Eleven NAVAIR program managers (PMs) and 16 competency leads were interviewed, and other stakeholders were surveyed online. Risk drivers were codified into a model based on lessons learned from PMs??? experience. A prototype LSI directional tool was developed and demonstrated. Four beta tests were conducted on NAVAIR programs to stress the model???s capability and to identify potential improvements.

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Acquisition Program Lead Systems Integration/Lead Capabilities Integration Decision Support Methodology and Tool[1]

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Abstract

Naval Air Warfare Center–Aircraft Division (NAWCAD) wants to ensure that program offices derive the best value for their resources. These program offices need to understand their most effective cost, schedule, and performance-based solutions when faced with an acquisition requirement. Comparisons for sourcing are complex and require extensive decision support analysis to understand the solution space and foresight between original equipment manufacturers (OEMs) and government entities performing the Lead System Integrator (LSI) role. The research focused on the question, how can program managers best determine their acquisition source solutions in a timely and cost-effective manner?

The method used was to develop a simulation tool to assist program offices in evaluating the relative risks of utilizing NAWCAD and commercial OEMs for various LSI roles and responsibilities. Lone Star Aerospace Inc. was tasked to develop a simulation tool to address highly complex issues for customers in NAVAIR.

Eleven NAVAIR program managers (PMs) and 16 competency leads were interviewed, and other stakeholders were surveyed online. Risk drivers were codified into a model based on lessons learned from PMs' experience. A prototype LSI directional tool was developed and demonstrated. Four beta tests were conducted on NAVAIR programs to stress the model's capability and to identify potential improvements.

Introduction

Signed January 7, 2015, Department of Defense Instruction (DoDI) 5000.2 states under Enclosure 2: Program Management,

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> The Program Manager will develop and execute an approved Acquisition Strategy. This document is the Program Manager's plan for program execution across the entire program life cycle. It is a comprehensive, integrated plan that identifies the acquisition approach and key framing assumptions, and describes the business, technical, and support strategies that the Program Manager plans to employ to manage program risks and meet program objectives. The strategy must reflect the Program Manager's understanding of the business environment; technical alternatives; small business strategy; costs, risks and risk mitigation approach. The plan supports successful delivery of the capability at an affordable life-cycle price, on a realistic schedule.
>
> The business approach detailed in the Acquisition Strategy should be designed to manage the risks associated with the product being acquired. It should fairly allocate risk between industry and the government. The approach will be based on a thorough understanding of the risks associated with the product being acquired and the steps that should be taken to reduce and manage that risk. The business approach should be based on market analysis that considers market capabilities and limitations. The contract type and incentive structure should be tailored to the program and designed to motivate industry to perform in a manner that rewards achievement of the government's goals.

This development of an Acquisition Strategy by the PM has become increasingly complicated by operating in a VUCA environment. *VUCA* stands for volatility, uncertainty, complexity, and ambiguity. A growing body of research on VUCA—including the 2014 dissertation of Dale Moore, Director of the Naval Air Warfare Center–Aircraft Division (NAWCAD) Strategic Cell—has recognized that a VUCA environment triggers more frequent strategic reorientations. When strategies change rapidly, organizations can flounder and resources can be wasted. When strategies do not adapt to the VUCA environment, they can become obsolete quickly, also triggering wasteful spending and suboptimal acquisition strategy, particularly for traditional program development lead times.

At the Defense Acquisition University Small Business Hot Topic Forum on May 8, 2013, Nickolas H. Guertin, PE DASN RDT&E, gave a brief on open systems architecture. The key message was that the legacy business model is one big program that equals one big contract and that a future business model will invoke competition across the life cycle using multiple acquisition sources.

The *NAVAIR Long-Range Strategy* (LRS) identified government as Lead Systems Integrator (LSI) as a future desired state (Naval Air Systems Command [NAVAIR], 2013). It involves development and management of government-owned capability, based on technical standards and re-use of engineering and test results associated with those standards to reduce acquisition cost.

In Better Buying Power 3.0 (BBP 3.0), Frank Kendall asserts, "Nothing is more important to our success than our professional ability to understand, think critically, and make sound decisions about the complex and often highly technical matters defense acquisition confronts" (Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics [OUSD(AT&L)], 2014), Underpinning BBP 3.0 is the growing concern that the United States' technological superiority over potential adversaries is being threatened today in a way that we have not seen for decades.

This new and focused BBP 3.0 initiative will strengthen the Department's organic military and government civilian technical expertise. The Department cannot be an effective customer for technical excellence and innovation if we do not embody those characteristics fully in our own workforce. We cannot make decisions about technology if we don't fully understand what is possible and how to achieve it.

In an *ITEA Journal* article, "DoD Labs, Navy Warfare Centers are Untapped Resources," RDML Michael Moran and SES Scott O'Neil discuss the 89% industry activity and the 11% government (Navy data) and how that needs to be re-examined along with considering more LSI work and leveraging in-house assets. Currently, the government workforce is not fully positioned to assume the LSI role on a broad scale, but if we engage early in the technical development efforts, whenever it makes sense, we can build a robust capability. Although this paper is specifically focused on experiences at Naval Air Warfare Center Weapons Division, there is anecdotal evidence showing that these issues are typical of many Navy/DoD warfare centers and laboratories.

Purpose and Research Question

The purpose of this qualitative research study is twofold. First is to provide PMs with a simulation tool to assist program offices in evaluating the relative merits and risks of utilizing NAWCAD and commercial OEMs for various LSI/LCI roles and responsibilities. Second is to understand where the government (NAWCAD) lacks competitiveness on the capability to perform LSI (identify the gaps). The research focused on the question, how can program managers best determine their acquisition source solutions in a timely and cost-effective manner?

NAWCAD wants to ensure that the program offices that it supports derive the best value for their resources. These program offices need to understand their most effective cost, schedule, and performance-based solutions when faced with an acquisition requirement. Comparisons for sourcing are complex and require extensive decision support analysis to understand the solution space and direct more detailed cost estimates between OEMs and government entities performing the LSI role or Lead Capabilities Integration (LCI) role.

Methodology

Extensive market research was conducted with leading edge technology, best practices, and analytical competitors like Lone Star Aerospace Inc., IBM, Decision Lens, Defense & Security Technology Group Inc., and Deloitte's Highly Immersive Visual Environment (HIVE). Additionally, a literature review was conducted to research state of the art publications, articles, and industry Communities of Interest (COI). Lone Star Aerospace Inc. was tasked to develop an LSI directional tool to assess Courses of Action (CoA) and provide relative risks of utilizing NAWCAD and OEMs.

The use of an appropriate decision process is important to provide best outcomes. During the execution of this research, the best practice of the Dialogue Decision Process from the *Handbook of Decision Analysis* was used (Parnell et al., 2013, Section 5.3). The dialogue decision process is a decision process that focuses on a structured dialogue between the Decision Board and Project Team. This was accomplished through several meetings that included a kick-off meeting, interim review meeting, LSI Directional Tool Demo/Feedback meeting, and the beta test out-brief.

A kick-off meeting for the LSI decision model was held October 24, 2013, with NAWCAD leadership, stakeholders, and subject matter experts (SMEs). The purpose was to

reach consensus on the model requirements, to establish support, synchronize, and provide guidance on alternatives and project strategy.

Model Requirements

The directional model needed to be able to assess roles, responsibilities, and functions of key entities and the elements that support those functions. The model also needed to be able to differentiate between two or more alternatives and be used across the entire life cycle or a portion of a program. This discrimination was a prelude to detailed planning which followed the analysis conducted with this model. The minimum areas for the model to assess in each Course of Action (CoA) were cost, schedule, technical performance, capability, and staffing risks. It also needed to be scalable to support all program types, as well as be validated on beta project(s).

Specifically, tools, processes, and analysis needed to provide insight to efforts being planned or performed, with emphasis on cost, time, labor mix, risk, and performance as key measures. The tool needed to be designed as a decision aid and was not meant to supplant or replace Program Executive Office (PEO), Program Management Air (PMA), or NAVAIR support systems.

An LSI decision model preliminary interim review meeting was held November 13, 2013. The preliminary interim review provided SME feedback on the proposed LSI decision model architecture, synchronized expectations, and provided guidance on next steps. Attendees conducted a review of the developing government LSI Decision Tool. The high level approach included Course of Actions (CoAs) based on MIL-STD-881 Work Breakdown Structure (WBS) level 2/3 and establishes a technical baseline that is consistent across all CoAs. High level model architecture included Control Panels, Baseline WBS Lv 2/3, Revised Baseline WBS Lv 2/3, Contractor Capabilities, Government Capabilities, and Decision Metrics.

SME Interviews

The next step in the process was to conduct SME interviews. This step provided insight into the merit of approach and architecture. The support and feedback received previous insights that were placed into a model influence diagram that was then developed into a mathematical structure with 98% of the math completed and the remaining notional data loaded into the demonstration.

Eleven NAVAIR deputy program managers and 16 competency leads were interviewed and other stakeholders were surveyed online. The results were used to codify risk drivers into the model based on lessons learned from PMs' experience. Program managers, deputy program managers, and competency leads were selected with the following criteria: (1) performed in a senior acquisition program management role, to include program manager or deputy program manager positions for over two years; (2) operated at a senior level of the organization (military 0-6/civilian GS-15, or equivalent) with significant responsibility; and (3) was involved with and responsible for developing and conceptualizing long-term acquisition program strategies and plans. Competency leads were selected for their technical expertise and knowledge.

Data was collected through 30-minute interviews with PMs and 60-minute interviews with competency leads. The interview sought to understand PMA perspectives and experiences in assessing entity role selection when planning and executing a project or program. An "entity" is an organization (industry or government) performing a significant role in a system or program. The interviews were conducted using the identified best practices in the *Handbook of Decision Analysis* as a guide (Parnell et al., 2013, Section 4.6).

Interview Questions

The interview questions were as follows:

1. When structuring the roles and responsibilities of various entities (across industry and government) in a program, what is your vision and/or objective when determining who has which roles and responsibilities?
2. We are tasked to look at Cost, Schedule, and Performance as criteria.
    a. What aspects of these three do you believe are the most important?
    b. What other criteria do you feel are important when assessing these roles and responsibilities?
3. Can you share an example of where an allocation of roles and responsibilities among entities has been defined and implemented well?
4. How was the lead role distributed among these entities?
5. How big of a factor are the "values" of the entity to you when determining the structure of the program as it relates to the roles and responsibilities?
6. What issues define compatibility among the entities that must collaborate for a successful program? In particular, what enables two or more entities to successfully create a systems capability?
7. Can you share an example of where an allocation of roles and responsibilities among entities has not been defined and implemented well?
8. What metrics are you held accountable to when executing a program?
    a. What is the source of the metric requirement?
    b. Where does the data for those metrics reside?
    c. Which of these metrics are most useful to you in executing your program?
    d. Which of these metrics provides any insight to the successful allocation of roles and responsibilities of the entities on your program?

Prototype LSI Directional Tool

An LSI Directional Tool Demo/Feedback meeting was held February 5, 2014. Attendees were both PMAs and NAWCAD leadership. The prototype LSI directional tool was developed to demonstrate user input and output formats. The purpose of the demonstration was to gather the voice of the customer for feedback, recommended changes, and improvements, and to synchronize expectations before locking into a final configuration and to identify the PMAs' desire to conduct beta tests.

Although the demonstrated model had notional data loaded, it demonstrated the effectiveness of the tool. Lone Star conducted surveys of the PMA, and competency and subject matter experts throughout industry to quantify the real world impacts to cost, schedule, and performance based on capability and program assessments. The survey data represented a quantified representation of the real world experience of program managers, competency leads, and industry SMEs. The information received subsequently replaced the notional data utilized prior to beta testing. Additionally, it was pointed out that NAWCAD is pursuing 21st century methodologies and tools to perform its mission in the future. These include product lifecycle management tools, digital engineering, cloud computing, data fusion, model-based research, and engineering, prototyping, and agile systems engineering, in which historical data does not exist.

The prototype allows a program manager to establish a Baseline CoA based on the program's level 2/3 WBS for cost, schedule, and performance.

The initial CoA can be anywhere on the continuum provided in Figure 1. The PM or Integrated Program Team (IPT) can evaluate potential CoAs for any combination of government or industry LSI activity at the system, sub-system, or component level.

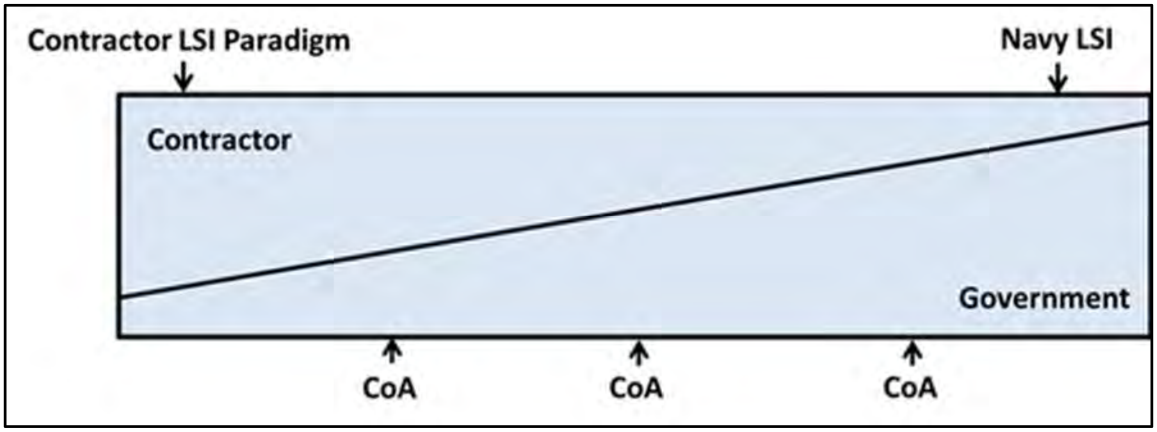

Figure 1. Courses of Action on a Continuum

Once the inputs are made for the Baseline CoA, the program IPT completes an assessment of the Baseline CoA in the following areas that drive risk:

- Technical complexity (TRL) and component or software re-use
- System complexity
- Program complexity
- Contract type
- Contract award time
- Integration readiness
- Proprietary data rights
- Competency of personnel
- Availability of personnel
- Facility readiness
- Security clearance status
- Pass through cost

These assessments result in a risk assessment of the Baseline CoA relative to the Baseline Inputs. Subsequent CoAs can then be assessed based on the reallocation of work between OEMs, the government, or another OEM. These CoAs can then be compared to each other to determine the relative risk of each CoA, as well as the most feasible course of action to take.

Risk Assessment Descriptions

Technical Complexity (TRL) and Component or Software Re-Use

The Technology Readiness Assessment (TRA) framework was developed to assess the maturity of technology elements via the established metrics of Technology Readiness Levels (TRLs). The TRL metric assigns a ranking to the maturity of the technology element using specific evaluation criteria; the scale can be used to assess the risk of developing and

transitioning new technologies in the context of a larger system acquisition. The framework of Re-Use is similar to TRL and assesses the percentage of re-use for any given WBS development effort.

TRL Levels

- TRL 1—Basic principles observed and reported
- TRL 2—Technology concept and/or application formulated
- TRL 3—Analytical and experimental critical function and/or characteristic proof-of concept
- TRL 4—Component/subsystem validation in laboratory environment
- TRL 5—System/subsystem/component validation in relevant environment
- TRL 6—System/subsystem model or prototyping demonstration in a relevant end-to-end environment (ground or space)
- TRL 7—System prototyping demonstration in an operational environment (ground or space)
- TRL 8—Actual system completed and "mission qualified" through test and demonstration in an operational environment (ground or space)
- TRL 9—Actual system "mission proven" through successful mission operations (ground or space)

Re-Use Levels

1 = Less than 10%

2 = 10-% - 20%

3 = 20% - 30%

4 = 30% - 40%

5 = 40% - 50%

6 = 50% - 60%

7 = 60% - 70%

8 = 70% - 80%

9 = 80% - 90%

10 = Greater than 90%

Once the detail hardware/software elements of each WBS are assessed, a System TRL and System Re-Use are computed based on weighting those elements based on cost. The derived System level TRL and Re-Use has proven effective in determining the level of risk to cost and schedule of a given CoA.

System Complexity

The work indicated that while TRL and Re-Use are important criteria and both should be considered and can be successfully modeled, a reliable method for categorizing system complexity to a usable scale for programs and products in government and industry is needed for objective planning and analysis.

System complexity has two dimensions:

- **Dimension 1**—Product & Context Complexity (Functions)

Lone Star Aerospace Inc. adapted research results from the MIT Sloan School that provide a relative complexity score for functions (Product and Context Complexity). The PMA assesses the complexity of the function of the system based on the following criteria:

1 = A part or component with a single function and one interface type

2 = A sub-assembly or mechanism, composed of #1s, with one or a few functions, and few interface types (these can be nested—sub-assemblies can merge to create more complex things that are still rated 2); a circuit board is a 2.

3 = A machine, apparatus, or functional item, composed of #2's which may have multiple, complex functions, and may have many interface types. Pacemakers, server blades and laser guided bombs are all 3's.

4 = A system or complex apparatus composed of 3's with highly complex functionally and diverse interface types. Communications satellites, air traffic control radars, airliners, telecom switches, and core network routers are all examples of 4's.

5 = A system of systems, composed of 4's (and lower complexity products). A telecom network, major airport, and carrier battle group are examples of 5's.

- **Dimension 2**—Interface Complexity & Information Diversity

For Interface Complexity/Information Diversity, the PMA will make an assessment on the complexity based on the following criteria:

1 = An interface of a single type, single purpose, and low information diversity

2 = An interface of 1 to 3 types, 1 to 3 purposes, and with low information diversity

3 = An interface more complex than #2 in only one or two descriptors

4 = An interface exceeding the complexity of #2 in all three descriptors

5 = An interface managing many #4's

When system complexity attributes are accounted for along with TRL and Re-Use, it provides program managers the ability to better plan for cost and schedule risk in their program as they develop program plans.

Program Complexity

Based on feedback through the interview process, the researchers determined that Program Complexity had two dimensions, namely customer complexity and supplier complexity. As each CoA is defined, the resultant structure of the program changes based on the number of pieces that might need to be managed. Lone Star developed a methodology to determine the impact to changes in the complexity of managing the program based on the CoA being evaluated.

Customer complexity consists of three components:

- The number and type of customers ranging from a single DoD customer to multiple DoD and international customers
- The number of contracts or contracting documents from that customer to be managed

- Whether the program is a development effort or is in production

Supplier complexity consists of two components:

- The types of supplier contracts to be managed, ranging from all “Build to Print” to all “Development” contracts
- The relationship with and between suppliers

Different CoAs will result in numbers of customers/suppliers, as well as the nature of the relationships required to execute a program. By accounting for the impact of these differences, the PM is better able to understand and manage the potential impacts to cost and schedule of any CoA.

Contract Type

A relationship between Contract Type and Contract Cost were established based on prior Lone Star research. The ability to execute within budget is impacted depending on the contract type utilized on a subcontract. Five contract types that are modeled include the following:

- Firm Fixed Price
- Firm Fixed Price w/ Simplistic Incentive Fee
- Firm Fixed Price w/ PMF Incentive Fee, Incentives, and Process Authority
- Cost Plus Fixed Fee
- Cost Plus w/ PMF Incentive Fee, Incentives, and Process Authority

Different CoAs will result in different quantities and sizes of contracts to be issued and managed. One CoA could have one large prime contract, while another could have multiple smaller contracts. While smaller contracts can result in smaller contracting cycle time, the people required to support multiple awards may or may not be available. Additionally, the PMA may or may not have sufficient insight or knowledge about the supply chain to support multiple awards.

Contract Award Time

Based on planning factors from Procurement Administrative Lead Time (PALT), the researchers modeled an estimated cycle time for contracting to be measured against a planned baseline. Historical contract cycle time is based on the following:

- Contract PALT #
- Contract PALT Type
- Contract Competitive/Any Value
- Contract Defined Price
- Contract Re-Use
- Contracting Resources

This provides the PM with insight to the cycle time required to get any given CoA under contract to begin execution.

Integration Readiness

Integration Readiness was based on Integration Readiness Criteria from AIR 4.1 and an Integration White Paper from Jennifer Long (2011). While TRL and Re-Use are important criteria and provide insight to the relative risk of a set of CoAs, the ability to integrate hardware and software together can pose significant risk to program execution if not accounted for in the evaluation of each CoA.

An Integration Readiness Level (IRL) assessment was developed that relates the "integration characteristics" of configuration items to integration risk levels. The assessment was structured along the same lines as the system complexity assessment, but was intended to allow assessment of the risk associated with software and hardware development of configuration items (CIs).

Proprietary Data Rights

DoDI 5000.2 (DoD, 2015) states under Enclosure 2: Program Management,

> (4) Intellectual Property (IP) Strategy and Open Systems Architectures.
>
> Program management must establish and maintain an IP Strategy to identify and manage the full spectrum of IP and related issues (e.g., technical data and computer software deliverables, patented technologies, and appropriate license rights) from the inception of a program and throughout the life cycle.
>
> The IP Strategy will describe, at a minimum, how program management will assess program needs for, and acquire competitively whenever possible, the IP deliverables and associated license rights necessary for competitive and affordable acquisition and sustainment over the entire product life cycle, including by integrating, for all systems, the IP planning elements required by subpart 207.106 (S-70) of the Defense Federal Acquisition Regulation Supplement (Reference (al)) for major weapon systems and subsystems thereof.
>
> The IP Strategy will be updated throughout the entire product life cycle, initially as part of the Acquisition Strategy, and during the Operations and Support Phase as part of the Life-Cycle Sustainment Plan.
>
> Program management is also responsible for evaluating and implementing open systems architectures, where cost effective, and implementing a consistent IP Strategy. This approach integrates technical requirements with contracting mechanisms and legal considerations to support continuous availability of multiple competitive alternatives throughout the product life cycle.

Competency and Availability of Personnel

People Readiness was characterized as having two components, including personnel competency and availability. The PMA is required to make an assessment to determine whether an executing entity has the competency and availability to perform the expected work by utilizing a Likert assessment scale calculated as follows.

- **Competency:**

  1 = No competency, sourcing can be obtained
  2 = Some competency with major additions needed
  3 = Most competencies with few additions needed
  4 = Most competencies with minor additions
  5 = All competencies are capable

- **Availability:**

  1 = None available, sourcing can be obtained
  2 = Some available with major additions needed
  3 = Most available with few additions needed

4 = Most available with minor additions
5 = All personnel are available

Facility Readiness

Facilities Readiness uses a Likert scale assessment of the facilities available to do the work, including Security readiness. The PMA will select whether an executing entity has

1 = None available, sourcing can be obtained
2 = Some available with major additions needed
3 = Most available with few additions needed
4 = Most available with minor additions
5 = All facilities available

Security Clearance Status

Clearance Availability is a Likert scale assessment of the availability of cleared people to do the work. The PMA will be able to select whether an executing entity has

1 = None available, sourcing can be obtained
2 = Some available with major additions needed
3 = Most available with few additions needed
4 = Most available with minor additions
5 = All cleared people available

By assessing the People, Facilities, and Clearance Availability of each executing entity of a given CoA, the program manager has the insight to the resources available to execute that CoA. Resource availability has a significant impact on the ability to meet schedule and ultimately cost. This assessment not only provides insight to schedule and cost risk to the program manager, the aggregation of this data provides NAWCAD with insight to resource areas that need to be developed or improved.

Pass Through Cost

Significant program savings may be realized when the government performs as a competitive, qualified LSI. AIR 4.2 Should Cost data shows that the representative supply chain profit is a substantial portion of the total weapon system's cost. This assumes a four tier supply chain, in which both profits decrease in lower tiers, and the percentage of outsourced materials decrease in lower tiers. There is an opportunity to assess all pass through rates using historical data across NAVAIR programs. This provides options for consideration for PMA acquisition decisions.

Allowing for Potential Variation in Impact Areas

Since the inputs, assessments, and impacts to those assessments are not deterministic, the variation in inputs and assessment impacts are accounted for in the modeling and simulation process.

Node	Layer	Input Node 10	Input Node 50	Input Node 90	Input Node LB	Input Node HB
Govt Contracting Plan Duration Pre-Election Current Phase	Baseline	0	0	0	0	0
Govt Contracting Plan Duration Pre-Election Future Phases	Baseline	0	0	0	0	0

Figure 2. Lead Time Required to Put Contract Vehicle in Place

The variation in potential data inputs to the model is captured by 50,000 Monte Carlo runs pulling a distribution of the data. This is called 10-base-90 format for the data. The

example given here in Figure 2 is for the lead time required to put a contract vehicle in place. During team assessments, the facilitator will ask the following questions:

- What is the minimum amount of time it could take to get on contract?
- What is the maximum amount of time it could take to get on contract?
- 10% of the time, how bad could it be?
- 10% of the time, how good could it be?
- What is a nominal realistic expectation of contract award timeline?

This creates dialogue and drives consensus on the appropriate distribution recorded into the model. The 10-base-90 format for the data is available for population across all risk drivers in the model. If required, the assessment team can reach back to the potential executing entities for insight on the risk driver in question.

This Monte-Carlo approach provides a distribution of potential LSI CoAs for the PM, evaluated from relative cost risk, schedule risk, and performance risk of potential outcomes. The relative risk curve is made up of 50,000 points representing 50,000 potential outcomes for a CoA.

These assessments result in a risk assessment of the Baseline CoA relative to the Baseline Inputs. Subsequent CoAs can then be assessed based on the reallocation of work between OEMs, the government, or another OEM. These CoAs can then be compared to each other to determine the relative risk of each CoA, as well as the most feasible course of action to take.

The prototype LSI directional tool was determined to be ready for beta testing. The beta testing included four programs of record that resulted in positive dialogue and participation.

Beta Project

Beta Test Objectives

Beta test objectives were designed to demonstrate the following:

- Model functionality in an operational environment with the Program Management office in the acquisition process
- Incorporate lessons learned from the beta programs into architectural changes to the model
- Identify and modify model reporting and graphics required for PMA use in the acquisition process
- Demonstrate directional merits of various courses of action regarding roles and responsibilities of executing entities enabling improved decision-making by NAVAIR leadership and PMs

Beta Criteria

The optimal beta programs selection was for the LSI model to test a diverse cross section of NAVAIR types of programs to exercise the different modules within the model and push the boundaries of the model's capability to identify areas for potential architectural improvement. The beta programs varied the degrees of technical, program, and system complexity, and considered different current and future program phases. The intent was to thoroughly explore cost, schedule, and performance questions as they evaluated CoAs and be scoped to fit into a six-week evaluation period.

Beta Programs

Optimal beta programs were selected based on a cross section of NAVAIR programs. They exercised different modules within the model and stressed the model's capability to identify areas for potential improvement. The beta programs had varying technical, program, and system complexity. Four programs of record were selected.

Beta Test Out-Brief

During beta testing, the model demonstrated the ability to rapidly change the WBS to be tailored by each program, and ran several CoAs running per day with each PMA. The results of the model runs were both informative and validated the survey data. The overall PMA responses were positive and it was recognized that the tool has application beyond LSI decisions. Beta test feedback indicated its usefulness for programmatic "what-if" analysis and other PMA decisions such as funding drills, Source Selection, and so forth. Beta tests were completed and out-briefed on August 27, 2014. An implementation plan was approved for future deployment.

Pilot Test With NAVAIR Programs

Future work includes conducting four pilot test programs as part of the deployment strategy. As of the date of this research paper, the pilots were not yet complete and are not included herein.

Findings

This section describes the findings of qualitative research involving 11 NAVAIR program managers (PMs) and 16 competency leads who met the specified criteria for this study related to their experience with acquisition. The findings were derived from 27 interviews and an online stakeholder survey. Risk drivers were codified into a model based on lessons learned from the PMs' experience. A prototype LSI/LCI directional tool was developed and beta tested on a cross-section of NAVAIR programs. This was conducted over a 10-month period. The composite findings described in this section include the participants' characterization and Lone Star Aerospace Inc. experience and expertise.

Beta Test Summary

The time invested by the IPTs who participated in the beta tests was approximately three days scheduled across four calendar days: a half-day introduction, two days of data gathering, and a half day of running the model. The model was quickly tailored to assess the relative risk impacts for each LSI approach. The model quantitatively demonstrated relatively low risk for government LSI approaches for one of the PMA-led efforts in which known contributions to risk were accurately predicted. The model was used in conversation with other PMAs to quantitatively demonstrate PMA success and compare government approaches to industry alternatives. The ability to execute multiple CoAs was demonstrated, allowing for "what-if" CoA assessments prior to execution to assess the relative risk of each proposed approach. The structured process of discussing and inputting the various options also led to better overall IPT understanding of the risks associated with each approach.

Observed Benefits for the Program IPT

Programmatic areas of assessment are based on known risk drivers and lessons learned from current program managers and IPTs. Potential LSI CoAs for the PM are evaluated from cost risk, schedule risk, and performance risk perspectives. The PMA should conduct the assessments as a group or team in the disciplined manner with the aid of the LSI/LCI directional tool. It is critical to have the right people in the room during the assessment. Key SMEs include the PM, technical experts, acquisition expert, AIR 4.2

Should Cost expert, IPT lead, and supply chain expert. The tool captures past IPT experience, perspectives, and insight applied to making future programmatic decisions. This creates rich evaluations and assessments of program areas that may not be discussed otherwise. It provides a quantitative and systematic means of making acquisition strategy decisions. The artifacts generated are defendable and provide a consistent means of communicating acquisition strategies to leadership and stakeholders. The key is the learning that occurs across the entire IPT as CoAs are run, iterated, and evaluated.

Observed Benefits for the Warfare Center

It is expected that once deployed, the aggregated data from different acquisition category (ACAT)–type programs will deliver key characteristics and insights that lead to programs choosing industry over the warfare center as an LSI. It should identify gaps in workforce competencies and arm government decision-makers with actionable knowledge to set strategy to become a competitive LSI. Analysis of aggregated data should illuminate policy limitations that prevent government-as-LSI decisions. It should provide leadership with the ability to make informed decisions on the hiring and training of personnel and support the creation of data-driven strategies for growth and improvement.

Interpretations, Conclusions, and Recommendations

The concept of providing a useful tool to the PMA for programmatic decisions that also allows NAWCAD to aggregate data on NAWC capabilities, people, and facilities proved to be extremely insightful. The model delivered LSI risk assessments as intended, with useful feedback to the PMA and NAWC in the beta phase. The PMA response in the beta phase was positive beyond intended LSI decisions, and the feedback indicated value for programmatic “what-if” analysis for other PMA decisions such as funding drills, sources selection, and so forth.

Based on the feedback, an architecture change to increase the skill set fidelity is currently being implemented along with IRL, Proprietary Data, and Pass Through cost. This will result in Version 1.1 that is ready for PMA use throughout NAWC. Version 1.1 will be deployed to institutionalize this new capability within the PMA community. This will provide the PMA community with immediate access to all “what-if” programmatic analyses, along with the quantitative back up necessary to support programmatic decisions.

The data generated by this tool also provides a basis for the manpower skill set requirements across different program types for both the PMA and NAWC. It will help NAWC to establish hiring, training, and knowledge management goals to meet its customers’ requirements. Organic integration capabilities provided by NAWC will then be improved to better support the PMA. Overall, the best value mix of government, OEM, and support contractors can be achieved.

It is recommended that a Version 1.2 be developed that provides a Web-Based Programmatic Decision Tool. This will provide the basis for enculturation across all of NAVAIR. The large data set of CoA analysis will provide NAWC with the information to support different ACAT-type programs more effectively in the areas of design, development, test, production, or sustainment based on what is the best value mix of government, OEM, and support contractors for the warfighter and the taxpayer. The research focused on the question, how can program managers best determine their acquisition source solutions in a timely and cost-effective manner? Although the LCI/LSI question was the rationale for the modeling, the simulation tool additionally allows comparison of a wide range of program structure alternatives through WBS tailoring. It was recommended that the tool has application far beyond LSI decisions.

Concluding Thoughts

The identification, development, and implementation of the Programmatic Decision Tool for LSI decisions followed a Dialogue Decision Process. It provides the PMA and NAWC with a tool necessary for adapting efficiently and effectively in a VUCA environment by facilitating collaborative decision-making with quantifiable rationale, providing the warfighter and taxpayer with the best value solution for LSI and other programmatic decisions.

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